(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 November 2001 (29.11.2001)

PCT

(10) International Publication Number
WO 01/90580 A1

(51) International Patent Classification[7]: F04C 29/08, 29/02, 29/00

(21) International Application Number: PCT/BE01/00090

(22) International Filing Date: 23 May 2001 (23.05.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2000/0353 25 May 2000 (25.05.2000) BE

(71) Applicant *(for all designated States except US)*: **ATLAS COPCO AIRPOWER, NAAMLOZE VENNOOTSCHAP** [BE/BE]; Boomsesteenweg 957, B-2610 Wilrijk (BE).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **BODART, Willy, Joseph, Rosa** [BE/BE]; Europalaan 28, B-2610 Wilrijk (BE).

(74) Agent: **DONNE, Eddy**; Bureau M.F.J. Bockstael nv., Arenbergstraat 13, B-2000 Antwerpen (BE).

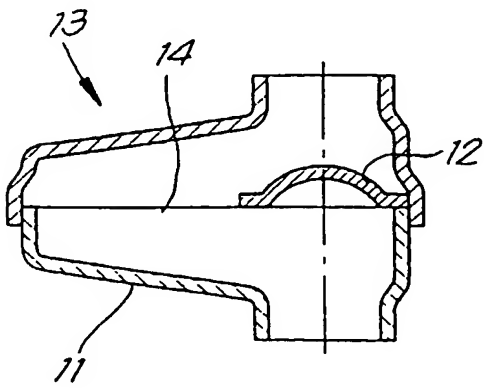
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: VOLUMETRIC COMPRESSOR INJECTED WITH LIQUID



(57) Abstract: The invention concerns a volumetric compressor injected with liquid comprising two rotors (1-2), which are erected in a compression chamber (3), means (5) for driving at least one of these rotors (1, 2), and means to inject liquid in the compression chamber (3). In the suction line (6) opening in the compression chamber (3) is provided an obstruction with at least one deflector (12) directed crosswise to the suction line (6) but leaving a passage (14) and which thus, without making the flow of fluid impossible, nevertheless prevents a straight flow of fluid in the suction line (6).

WO 01/90580 A1

Volumetric compressor injected with liquid.

The present invention concerns a volumetric compressor injected with liquid comprising one or several compressing parts erected in a compression chamber and bearing-mounted in a housing, means for driving at least one of said compressing parts, a suction line opening in the compression chamber, an exhaust line and means to inject liquid in the compression chamber.

In known volumetric compressors of this type, the exhaust line is connected to a compressed air receiver over a non-return valve, whose outlet is connected to the distributing net of compressed air via a cooler.

Liquid, usually oil or water, which is injected in the compression chamber for the lubrication and cooling of the compressing parts, is discharged together with the compressed air and is separated again in the compressed air receiver and fed back to the compression chamber via a filter and a valve.

During the compression of the compressing parts, air is sucked in the compression chamber via an air filter and said suction line, over the non-return valve, and, after being compressed, it is forced to the compressed air receiver via the exhaust line over the non-return valve in this line.

In the known volumetric compressors, a non-return valve is also provided in the suction line, which makes sure that when the compressor is stopped, no lubricating liquid flows out of the compression chamber through the suction line,

thanks to the expansion of the air. When the compressor is stopped, the non-return valve in the exhaust line and the valve in the return line for the lubricating liquid are not entirely closed.

The non-return valve in the suction line is a relatively expensive part, however.

Moreover, it contains moving parts, which implies that its operation can be disrupted and that it is subject to wear. In the case of a compressor which is often started and stopped, it may be necessary to replace the non-return valve in the suction line from time to time.

The invention aims a volumetric compressor injected with liquid which does not have the above-mentioned and other disadvantages and which can also operate without a non-return valve in the suction line.

This aim is reached according to the invention in that in the suction line is provided an obstruction with at least one deflector directed crosswise to the suction line but leaving a passage and which thus, without making the flow of fluid impossible, nevertheless prevents a straight flow of fluid in the suction line.

The gas which is sucked in during the operation of the volumetric compressor flows around the deflector. Gas and liquid being carried along, which are forced out through the suction line when the volumetric compressor is stopped, collide with the obstacle, as a result of which the major part of the liquid is stopped and sent back to the compression chamber. The rest of this liquid is precipitated in the passage due to the change of direction.

The deflector of the obstacle can be erected at a widening of the suction line, opposite to the extension of the part of the suction line situated between the widening and the compression chamber, whereas the passage is situated in the widening and has the shape of a hairpin bend.

In this embodiment, the sucked-in gas can flow along the obstacle without much hindrance and thus with a reduced pressure loss.

The size of the deflector situated diagonally on the suction line is preferably larger than the section of the part of the suction line situated between the widening and the compression chamber.

The passage around the deflector preferably has a larger surface next to the deflector than the section of the part of the suction line situated between the widening and the compression chamber.

As the size of the passage around the deflector is larger than the section of the part situated between the widening and the compression chamber, the speed of the liquid particles will be slowed down, as a result of which they will precipitate faster.

The deflector of the obstacle may have a part which is bent in a hollow manner towards the compression chamber.

The widening and the deflector may be part of a separate component which is built-in in the suction line.

The obstacle may have several deflectors which are erected crosswise in the suction line but which, when erected at a widening, may consist of a single baffle plate.

In order to better explain the characteristics of the invention, the following preferred embodiment of a volumetric compressor injected with liquid according to the invention is described as an example only without being limitative in any way, with reference to the accompanying drawings, in which:

figure 1 represents a side view of a screw-type compressor injected with liquid according to the invention;
figure 2 represents the part indicated by F2 in figure 1 to a larger scale and which contains a part of the suction line;
figure 3 represents a top view of a component which is part of the part of the suction line represented in figure 2;
figure 4 represents a suction according to line IV-IV in figure 3;
figure 5 represents a side view of the component represented in figures 3 and 4.

Figure 1 represents a screw-type compressor injected with water containing two rotors 1 and 2 erected in a compression chamber 3 which is limited by a housing 4.

The rotors 1 and 2 are bearing-mounted with their far ends in this housing 4.

The rotor 1 is driven by a motor 5 and drives the rotor 2 by means of contact.

In the compression chamber 3, at the top and on the low-pressure side, opens a suction line 6, whereas on the high-

pressure side is connected an opening line 7 in which is erected a non-return valve 8.

The screw-type compressor further contains means for injecting water in the compression chamber 3, onto the rotors 1 and 2, of which means only the line 9 is represented. This water forms the lubricant for the rotors 1 and 2 and also cools the latter.

The above-mentioned means may contain a water separator and/or an air receiver in the exhaust line 7 which are not represented here, where water is separated from the compressed air and from where the water is fed back to the compression chamber 3 via the line 9.

In the suction line 6 is provided an air filter 10 and, between the air filter 10 and the compression chamber 3, said suction line 6 is provided with a widening 11 and, at the height of the widening 11, with an obstacle in the shape of a deflector 12.

The widening 11 and the deflector 12 mounted therein are part of a separate component 13 in the given example, which is built-in in a vertical part of the suction line 6 and which is represented in detail in figures 3 to 5.

This component 13, for constructional reasons, consists of two parts fixed to one another. As is represented in figure 4, the edge of the part represented at the bottom in this figure, turns into the deflector 12 which is erected crosswise to the longitudinal direction of the suction line 6 and thus crosswise to the flow direction of the fluid, i.e. the sucked-in air or air with liquid particles forced out of the compression chamber 3.

Said deflector 12 is connected to the edges of the component 13, except at the height of the widening 11 extending towards one side, away from the deflector 12.

Thus, said deflector 12 is situated diagonally opposite to the theoretical extension of the parts 6A and 6B of the suction line 6 which are situated between the component 13 or the widening 11 and the compression chamber 3 and the air filter 10 respectively.

Also the surface of the deflector 12, seen crosswise onto the suction line 6, is larger than the section of the above-mentioned parts 6A and 6B of the suction line 6.

The middle part of the deflector 12 is bent in a hollow manner towards the compression chamber 3.

In the widening 13, between the deflector 12 and the inner side of the component 13, is formed a passage 14. Opposite to the deflector 12, this passage 14 has a section which is larger than the section of the above-mentioned parts 6A and 6B of the suction line 6.

During the normal operation of the screw-type compressor, air is sucked in via the suction line 6.

The sucked-in air has to flow around the deflector 12 and thus through the passage 14 in the component 13.

Thanks to the large surface of the passage 14, the pressure drop is limited, however.

When the screw-type compressor is stopped, the non-return valve 8 will be closed in the exhaust line 7 and, as this non-return valve 8 is provided with sealing rings, it will

entirely shut off the exhaust line 7. Also the water supply via the line 9 will be stopped by a valve in this line 9 which is not represented here, which also provides for a complete sealing, so that no pressure or water from the exhaust line 7 or the line 9 penetrates into the compression chamber 3 again.

Thanks to the expansion of the air in the compression chamber 3, when the compressor is stopped as mentioned above, air with water particles will be pressed in the suction line 6.

This flow of air with water particles collides with the deflector 12. Thanks to this deflector 12, and especially thanks to the hollow side thereof, this air and especially the liquid particles therein will be sent back to the compression chamber 3.

The air with liquid particles which is not stopped has to flow through the passage 14 and make a hairpin bend around the deflector 12.

Thanks to the larger surface of said passage 14 in relation to the section of the rest of the suction line 6, the speed of the air decreases, as a result of which the liquid particles which are carried along fall and flow back to the compression chamber 3.

Naturally, the invention can also be applied with other gases than air being compressed, and the injected liquid does not necessarily have to be water, but it may also be oil or such.

The obstruction must not necessarily consist of a single deflector having the above-described shape. This obstacle

may form a labyrinth of a number of deflectors situated crosswise in relation to one another. A widening can possibly be omitted in this case.

The invention is by no means limited to the above-described embodiments represented in the accompanying drawings; on the contrary, such a volumetric compressor injected with liquid can be made in all sorts of variants while still remaining within the scope of the invention.

Claims.

1. Volumetric compressor injected with liquid comprising one or several compressing parts (1-2), for example two rotors (1-2), which are erected in a compression chamber (3) and which are bearing-mounted in a housing (4), means (5) for driving at least one of said compressing parts (1,2), a suction line (6) opening in the compression chamber (3), an exhaust line (7) and means to inject liquid in the compression chamber (3), characterised in that in the suction line (6) is provided an obstruction with at least one deflector (12) directed crosswise to the suction line (6) but leaving a passage (14) and which thus, without making the flow of fluid impossible, nevertheless prevents a straight flow of fluid in the suction line (6).

2. Volumetric compressor according to claim 1, characterised in that the deflector (12) of the obstacle can be erected at a widening (11) of the suction line (6), opposite to the extension of the part (6A) of the suction line (6) situated between the widening (11) and the compression chamber (3), whereas the passage (14) is situated in the widening (11) and has the shape of a hairpin bend.

3. Volumetric compressor according to claim 2, characterised in that the size of the deflector (12) situated crosswise to the suction line (6) is larger than the section of the part (6A) situated between the widening (11) and the compression chamber (3).

4. Volumetric compressor according to claim 2 or 3, characterised in that the passage (14) around the deflector (12), next to the deflector (12), has a larger surface than the section of the part (6A) of the suction line (6) situated between the widening (11) and the compression chamber (3).

5. Volumetric compressor according to any of claims 2 to 4, characterised in that the widening (11) together with the deflector (12) forms a separate part which is built-in in the suction line (6).

6. Volumetric compressor according to any of claims 2 to 5, characterised in that the obstacle consists of a single deflector (12) at the height of the widening (11).

7. Volumetric compressor according to any of the preceding claims, characterised in that the deflector (12) of the obstacle contains a part which is bent in a hollow manner towards the compression chamber (3).

8. Volumetric compressor according to any of the preceding claims, characterised in that the deflector (12) mainly extends horizontally.

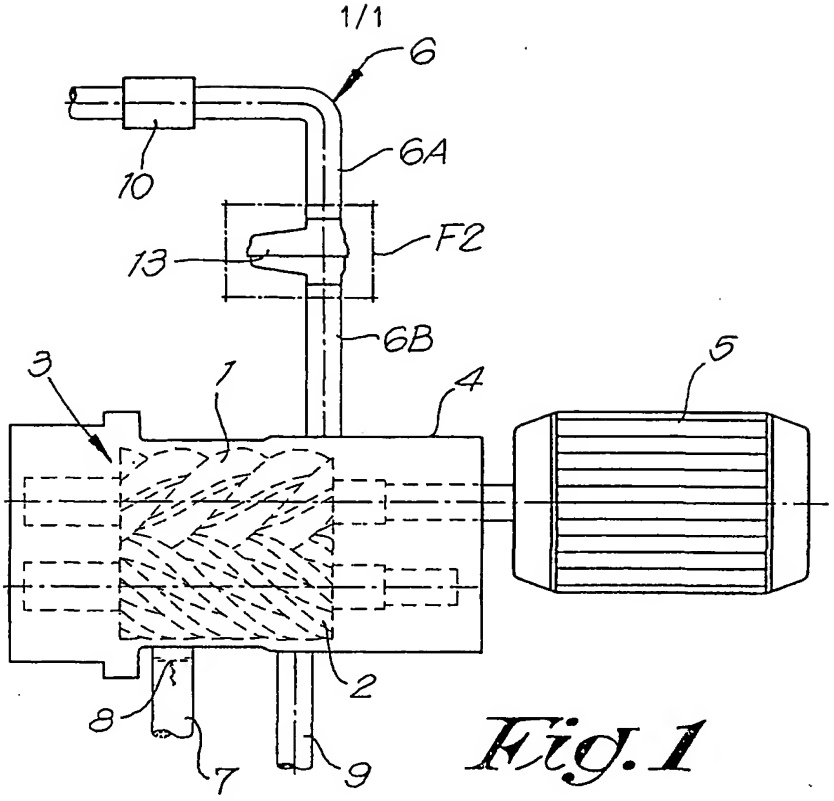


Fig.1

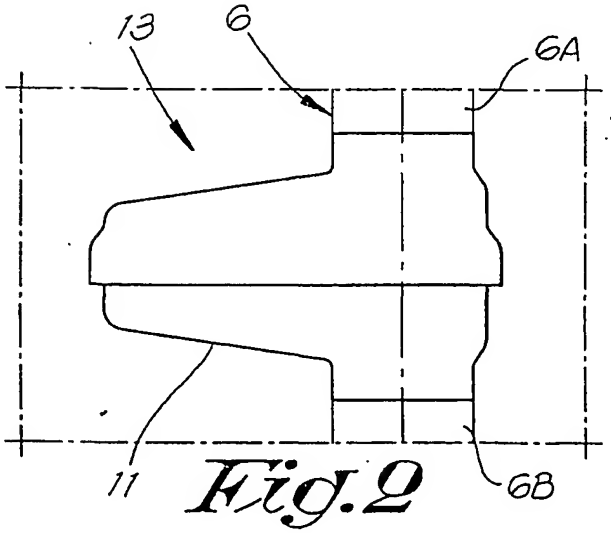


Fig.2

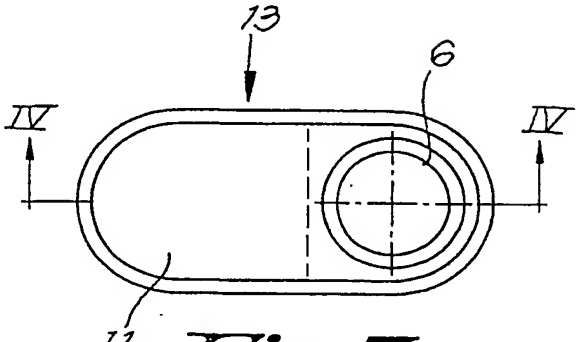


Fig.3

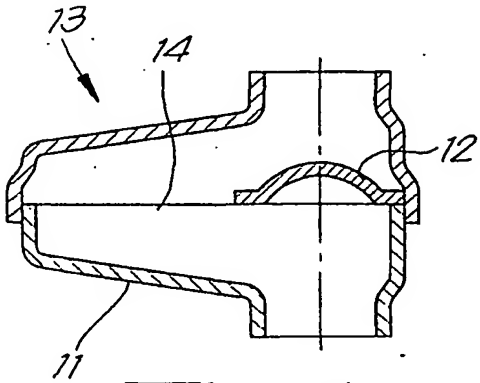


Fig.4

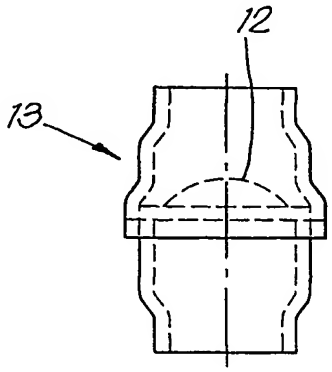


Fig.5

INTERNATIONAL SEARCH REPORT

Ir onal Application No
PCT/BE 01/00090

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F04C29/08 F04C29/02 F04C29/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F04C B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FR 1 083 968 A (PLANCHE M.) 14 January 1955 (1955-01-14) the whole document page 1, column 1, line 24 - line 28; figure 1	1
Y	GB 888 237 A (DAVIES & METCALFE LTD.) 31 December 1962 (1962-12-31) page 1, line 22 -page 2, line 39; figure 1	1
A	US 1 735 441 A (PAFFEN P.J.) 12 November 1929 (1929-11-12) figure 1	1

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 August 2001	27/08/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ingelbrecht, P

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 006, no. 249 (M-177), 8 December 1982 (1982-12-08) & JP 57 146095 A (HITACHI SEISAKUSHO KK), 9 September 1982 (1982-09-09) abstract	1
A	EP 0 629 778 A (ATLAS COPCO AIRPOWER NV) 21 December 1994 (1994-12-21) the whole document	1

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 1083968 A	14-01-1955	NONE	
GB 888237 A	31-01-1962	NONE	
US 1735441 A	12-11-1929	NONE	
JP 57146095 A	09-09-1982	NONE	
EP 0629778 A	21-12-1994	BE 1007135 A	04-04-1995
		AU 667771 B	04-04-1996
		AU 6050394 A	22-12-1994
		CA 2121763 A	17-12-1994
		DE 69407665 D	12-02-1998
		DE 69407665 T	16-07-1998
		DK 629778 T	07-09-1998
		ES 2114126 T	16-05-1998
		JP 7004372 A	10-01-1995
		US 5531571 A	02-07-1996